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(54) CLOSURES

(71) We, METAL BOX LIMITED, of Queens House, Forbury Road, Reading, RG1 3JH, Berkshire, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to closures for containers, and to containers having such closures.

In accordance with the invention from one aspect there is provided a container which comprises a tubular body portion having an end formed with an aperture, and a closure member sealingly snap-engaged onto the body portion so as to overlie the said end, the closure member having a dispensing aperture and being rotatable on the body portion between a position in which the said apertures are aligned to enable matter to be inserted in, or removed from the container, and a position in which the apertures are fully out of alignment and the container is closed, one or the other of the closure member and the said end of the body portion having a continuous resilient lip surrounding its said aperture and arranged to make wiping engagement with a plane opposed surface of the said end of the body portion or the closure member, as appropriate, as the closure member is rotated, the closure member of the said end of the body portion, as appropriate, having a further resilient lip similar to the first and diametrically opposed thereto at the same radius in the other side of the rotational axis of the closure member for wiping engagement with the said plane opposed surface, within the said second resilient lip the closure member or said end of the body portion being unapertured.

In order that the invention may be more fully understood an embodiment thereof will now be described, by way of example, with reference to the accompanying drawing which shows a closure in diametral section and in relation to a container tube to which the closure is fitted.

Referring now to the drawing, a closure is shown in relation to a blood collection tube 10. The tube, which is depicted in part only and in broken lines, has the form of a cylinder with a constant wall thickness and integrally closed at its bottom end (not shown). It is injection-moulded from clear styrene acrylonitrile plastics material.

The closure is formed of two parts which are individually and separately injection-moulded from low density polyethylene, and are snap-engaged together for relative rotation about the central axis XX of the container as a whole. The first of these parts, generally denoted 11, comprises a tubular skirt 12 formed part way down its length with an external annular flange 13 having upper and lower plane surfaces 60, 61, and a transverse panel 14 which closes one end of the skirt, the top end as shown.

The portion 19 of the skirt 12 lying below the flange 13 is dimensioned to be force-fitted into the mouth of the tube 10 until, as shown, the lower surface 61 of the flange engages the plane terminal edge 15 of the tube to prevent further movement and so locate the closure and tube in relation to one another in the longitudinal sense. The skirt 12 frictionally engages the tube bore at a cylindrical surface 16. To assist initial entry for automatic assembly the skirt is formed with an external chamfer 17 and the tube is formed with an internal chamfer 18.

The top panel 14 is formed with an aperture 21 which is offset from the axis XX. The aperture is generally part-spherical; it extends through the top panel and has its mouth defined by an annular deformable lip 22 which projects upwardly and inwardly from the upper surface 23 of the top panel to a free terminal edge 24. This edge lies on approximately the same radius as the circular feather-edge 25 which the aperture 21 forms on the plane undersurface 26 of the top panel by virtue of its arcuate shape.

A further deformable lip, identical to the lip 22 and accordingly given the reference 22^1, is formed on the top panel 14 as a

mirror image of the first lip in relation to the axis XX. However, whereas the lip 22 defines the mouth of a through bore in the top panel, viz. the aperture 21, the top panel within the lip 22^1 is closed so that no through bore is formed.

The part 11 of the closure is completed by an annular bead 27 which is rooted at the junction between the skirt 12 and the top panel 14 and projects outwardly and upwardly beyond the top panel upper surface 23. The bead 27 has parallel and frustoconical upper and lower surfaces 41, 42, and a rounded end 43. It is dimensioned for snap-fit engagement within the second part 31 of the closure, now to be described in detail.

Like the part 11, the part 31 of the closure comprises a top panel (32) and a depending peripheral skirt (33). The skirt 33 is generally cylindrical and disposed in concentric relation to the portion 20 of the skirt 12 above the flange 13, while the panel 32 is generally plane and disposed in overlying relation to the top panel 14. The skirt 33 is externally knurled as at 34 to assist gripping by the user.

The above-mentioned groove in the closure part 31 is formed between the plane undersurface 35 of the top panel 32, and a frustoconical shoulder 36 which is formed on the inside of the skirt 33 and has the same cone angle as the undersurface 42 of the bead 27. The groove has a cylindrical base wall 28 provided by the skirt 33.

The top panel 32 of the part 31 has its top surface 45 recessed at a large diameter cylindrical wall 46. A circular boss 47 projecting upwardly from the surface 45 forms the mouth of a dispensing aperture 48 which extends vertically through the panel 32 and is centred on the same radius, in relation to the axis XX, as the aperture 21 and lips 22, 22^1 of the closure part 11.

A chamfer is formed at the lower end of the aperture 48 where it joins the undersurface 35 of the top panel 32. This chamfer is a mirror image of an identical formation defining a recess 50 which is formed in the surface 35 on the same radius as the chamfer and on the opposite side of the axis XX. The chamfer and its mirror image are respectively denoted 49, 49^1.

To assemble the closure for later attachment to the container tube 10 as previously described, the closure part 31 is snap-engaged over the portion 20 of the closure part 11 by relative axial movement of the closure parts along the axis XX; to assist the snap-engagement action the interior surface of the skirt 33 below the shoulder 36 is downwardly and outwardly flared at a frustoconical surface 65, the portion 20 of the skirt 12 being flared to correspond. After assembly, as shown in the drawing, the bead 27 is snugly received in the internal recess of the part 31 with its undersurface 42 in face-to-face contact with the shoulder 36 and with its rounded end 43 in engagement with the cylindrical wall 28 at the base of the recess. It will thus be understood that the part 31 is then held captive on the part 11 for rotation on the same. As shown, a clearance is provided between the plane terminal face 37 of the skirt 33 and the upper surface 60 of the flange 13.

The two closure parts are relatively dimensioned so that in the assembled closure the lips 22, 22^1 are at all times downwardly and inwardly deformed to a lesser or greater extent by the part 31, by virtue of the above-described engagement of the surfaces 42, 36. Furthermore, the lips are of such a diameter and shape that they are capable of nesting within the chamfers 49, 49^1 when the closure parts are in an appropriate relative angular position. When, as shown, the angular position is such that the lip 22^1 engages the chamfer 49 and the lip 22 correspondingly engages the chamfer 49^1, the aperture 21 is closed by the top panel 32 within the chamfer 49^1 so that the closure forms a fluid-tight seal for the tube 10. However, by turning the closure part 31 through 180° on the part 11 so that the items 22, 51 and, correspondingly 22^1, 51^1 are brought into engagement, the two apertures are brought into alignment and blood can be dispensed from the tube.

At all times the lips 22, 22^1 resiliently engage the top panel 32, either at the chamfers 49, 49^1 or at the undersurface 35. In so doing they ensure a fluid tight seal preventing the escape of blood along the interface between the parts.

Furthermore, by engaging within the chamfers 51, 51^1 in a resiliently deformed manner they provide positive location for the part 31 on the part 11 at two angular positions in one of which the closure is 'open' and in the other of which, spaced 180° from the first, the closure is 'closed'. Thus a user operating the closure can readily sense the closure position which he desires, so that if the closure is operated correctly there is no possibility, for example, that the closure when intended to be closed is, in fact, partially open.

A further desirable feature of the described arrangement is that the forces which the lips 22, 22^1 individually exert on the closure part 31 and tending to make it tilt on the closure part 11 are at all times equal and opposite. Thus there is never any tendency for the closure part 31 to adopt an inclined attitude on the closure part 11, so that the fluid tightness of the seal provided between the parts is further assured.

In a modification of the described arrangement the action of the lips 22, 22^1 to locate the closure part 31 positively in its open and

closed positions is augmented by stops (not shown) which are provided on the two closure parts so as by mutual engagement to provide end limits to the possible relative rotation of the parts. The stops are disposed so that the two limiting positions correspond respectively to the open and closed conditions of the closure.

In use of the described arrangement the blood collection container is assembled by the manufacturer by snap-engaging the parts 11, 31 together and then push-fitting the part 11 into the tube 10. The container is completed by rotating the part 31 as necessary to fully close the container in the manner previously described, and in this condition is despatched to the user which may be a hospital, surgery or the like.

To use the container the operator turns the part 31 to open the container, and injects a sample of blood into the container through the aligned apertures 21, 48 using the syringe by which the sample was taken with or, possibly, without its needle still in position.

During this injection the plane upper surface 78 of the boss 47 is engaged by a corresponding surface of the syringe to position the syringe and container in relation to one another. In order to ensure that this engagement does not form a seal preventing or impeding the escape of the displaced air from the container interior, the boss is preferably cut away over part of its periphery to provide a leakage path for this air.

After the container has been charged with the blood sample it is closed and dispatched to a laboratory for testing. The design of the container is such that part of the sample may then be easily extracted, or additives made, using a pipette inserted through the dispensing aperture 48 when the container is open.

A particular feature of the described container is that the closure is held captive on the tube, and moreover can be manipulated between its open and closed positions by the hand which the operator uses to hold the container. Thus the container only requires the operator to use one hand for holding and operating it, his or her other hand thereby being freed for manipulating the syringe, pipette or the like or other associated operations.

Although particularly described in relation to a two-part closure adapted for attachment to a container body, the invention includes within its scope container arrangements in which one part of the closure forms an integral part of the container body and has the other part of the closure rotatably fitted onto it. In a non-illustrated container which is a modification of the described embodiment a tubular body is closed at one end by a conventional push-fitted end closure and has its other end closed by a closure part which is similar to the part II of the described embodiment but moulded integrally with the body rather than frictionally attached to the same. A further closure part, analogous to the part 31, is rotatably fitted on the first. The tubular body is internally subdivided into two half-cylindrical chambers by a diametrally disposed partition extending down its length. Four lips 22 are provided at 90° intervals on one closure part, for engagement with correspondingly arranged chamfers 49 on the other closure part. Of the lips and chamfers two of each, disposed on a diameter of the closure, are associated with apertures 21 or 48 as appropriate, and it will therefore be understood that by manipulation of the closure different products in the two chambers can be dispensed together or shut off together as desired. Stops are preferably provided on the closure parts to limit the relative rotation which is possible between the parts to 90°, so that the apertures 48 are always used for the same product.

In a possible modification of the described arrangement, which may be used in conjunction with the above modification or otherwise, the lips 22 and 22^1 are provided on the closure part 31 and the chamfers 49 and 49^1 on the closure part 11.

The invention has wide application to the packaging of liquid and particulate materials not only for medical use (as particularly described) but in, for example, the food industry. It is of particular value where fluid-tightness is required.

WHAT WE CLAIM IS:—

1. A container, which comprises a tubular body portion having an end formed with an aperture, and a closure member sealingly snap-engaged onto the body portion so as to overlie the said end, the closure member having a dispensing aperture and being rotatable on the body portion between a position in which the said apertures are aligned to enable matter to be inserted in, or removed from the container, and a position in which the apertures are fully out of alignment and the container is closed, one or the other of the closure member and the said end of the body portion having a continuous resilient lip surrounding its said aperture and arranged to make wiping engagement with a plane opposed surface of the said end of the body portion or the closure member, as appropriate, as the closure member is rotated, the closure member or the said end of the body portion, as appropriate, having a further resilient lip similar to the first and diametrically opposed thereto at the same radius on the other side of the rotational axis of the closure member for wiping engagement with the said plane opposed surface,

within the said second resilient lip the closure member or said end of the body portion being unapertured.

2. A container according to Claim 1, wherein the body portion comprises a tubular body integrally closed at one end, and an end portion push-fitted into the other end of the body and providing the said end of the body portion.

3. A container according to any preceding claim, which includes an upstanding boss formed around the dispensing aperture on the outside of the closure member.

4. A container according to any preceding claim, which includes stops on the closure member and the body portion and arranged for limiting relative rotational movement of these members between a first position in which the apertures are aligned and the container is open and a second position in which the aperture in the said end of the body portion is fully closed by the closing member.

5. A container substantially as herein described with reference to Fig. 1 of the accompanying drawings.

6. In combination, an end member and a closure member substantially as the parts respectively referenced 11 and 31 in Fig. 1 of the accompanying drawings.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale